PATENT
Attorney Docket No. 8124.006.US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Vincent B. HO : Group Art Unit: 2609

App. No.: 10/686,194 : Examiner: Woldemariam, Akililu

Filed: October 9, 2003 : Confirmation No. 3778

Title: PIXELATION RECONSTRUCTION FOR IMAGE RESOLUTION AND IMAGE DATA TRANMISSION

MAIL STOP: AMENDMENT

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

DECLARATION UNDER 37 C.F.R. § 1.131

We, Vincent B. Ho, with a residence address at 11908 Castlegate Court, North Bethesda, Maryland 20852, and Micah D. Schmidt, with a residence at 9931 Hyatt Resort Drive, Apt. 926, San Antonio, Texas 78251, are co-inventors of the invention disclosed and claimed in the above-captioned patent application.

Prior to September 26, 2001, we conceived and reduced to practice the systems and methods according to the claims of the instant patent application, at least to the extent that such systems and methods are disclosed in U.S. Patent Application No. 6,885,776 (Takakura). Accordingly, Takakura cannot be considered to be prior art to our claimed invention.

In support of this Declaration, attached hereto is a document that was prepared by us prior to September 26, 2001 ("Exhibit A"). As clearly established by this document, we conceived and reduced to practice the systems and methods according to the claims of the instant patent application prior to Takakura, at least to the extent that such systems and methods are alleged to be disclosed in Takakura.

To assist the Examiner in evaluating Exhibit A, the following remarks are provided highlighting certain statements within Exhibit A.

Claim 1, as it currently stands, recites:

> *A method for improving resolution of a two-dimensional image capable of being acquired from an object at a first pixel size, comprising:*
>
> *defining a sampling region for producing said image at a second pixel size, said second pixel size being no larger than said first pixel size;*
>
> *sampling, with an overlapping increment, said sampling region thereby producing a multiplicity of sample layers, said overlapping increment being no larger than said first pixel size thereby determining said second pixel size;*
>
> *obtaining values of the pixels of the second pixel size in each of the multiplicity of sample layers;*
>
> *computing the value of each pixel of said second pixel size from the values of the corresponding pixels in the multiplicity of the sample layers, thereby producing an intermediate image; and*
>
> *dividing, in the Fourier domain, said intermediate image by a filtering function thereby producing said image at the second pixel size, said filter function being capable of representing artifacts from the multiple sampling.*

Applicant directs the Examiner to Exhibit A which discusses the concept of the invention. For instance, on page 10, in the first bullet point, "*a region V* x_1,y_1,z_1 *to* x_2,y_2,z_2" is defined. This region is comparable to the first pixel of claim 1. On page 10, in the fourth bullet point "*a new region C*" is defined. This region is comparable to the second pixel of claim 1. Furthermore, region C is "*of the size of V with room for a buffer of size l-dl.*" Therefore, C is smaller than V and, thus "*said second pixel size being no larger than said first pixel size*" as recited in claim 1.

Bullet points 6 and 7 on page 10 refer to multiple sampling regions that overlap. This is comparable to the step of "*sampling, with an overlapping increment, said sampling region thereby producing a multiplicity of sample layers*" recited in claim 1. On page 11, at bullet 2, mapped intensity values of region C are obtained. This is comparable to "*obtaining values of the pixels of the second pixel size*" as recited in claim 1. On page 11, at bullet 2, an equation is given to compute "*the value of each pixel*" as recited in claim 1. Additionally, on page 18, the back-fill reconstruction is described, which is comparable to "*dividing, in the Fourier domain, said intermediate image by a filtering function*" as recited in claim 1.

Likewise, the elements of independent claims 4, 16, 19, 29, 30, 32, 33, 47, and 49 can all find similar support in the documents from Exhibit A. Finally, on page 24 of Exhibit A, the third section describes "image restoration testing" thereby showing that the invention was reduced to practice since tests were being conducted on it.

The above-noted quotes from Exhibit A are provided for the convenience of the Examiner only. Other sections of Exhibit A disclose additional elements of our claimed invention and, further, provide a clear context for the invention. Accordingly, we respectfully request that Takakura be removed as a prior art reference.

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the above-identified application or any patent issued thereon.

By: ____________________________ Date November __, 2008
Name: Vincent B. Ho

By: ____________________________ Date November __, 2008
Name: Micah D. Schmidt
Attached: Exhibit A

EXHIBIT A

back projection process description

- begin w/ a pt in space P at an unknown location within a region V x_1, y_1, z_1 to x_2, y_2, z_2

- assume the intensity of P is some value I_p and that the intensity of every other point is 0.

- Begin to sample region V with a cuboidal sample region S of size ℓ in such a way that S just overlaps region V at point (x_1, y_1, z_1) ~~by~~ some value $d\ell$
  - Call this sample position $(0, 0, 0)$
- Create a new region C of the size of V with room for a buffer of ~~of~~ size $\ell - d\ell$.

- measure the average intensity of the sample region S and asign that value ~~that~~ to every point in a corresponding region in C.
  - if S overlaps P then the intensity of $S = I$ else intensity of $S = 0$

- move sample region S one step $d\ell$ to a new position along the x axis and repeat.
- continue until the sample region just ovelaps V by $\leq d\ell$ then incriment by $d\ell$ in the y direction across the plane and then in the z direction across region V.

- the algorithm for sampling positions of S would be as follows

$$xn = \text{number of steps on x axis} = \frac{x_2 - x_1}{d\ell} + \frac{\ell}{d\ell}$$

$$Y_n = \frac{Y_2 - Y_1}{d\ell} + \frac{\ell}{d\ell} \qquad Z_n = \frac{Z_2 - Z_1}{d\ell} + \frac{\ell}{d\ell}$$

```
for (z = 0; z <= Zn; z++)
  for (Y = 0; Y <= Yn; Y++)
    for (x = 0; x <= Xn; x++)
      { - sample region S
        - add avg value Intensity $\overline{I_S}$
          to every corresponding point in C
      }
```

- Take the region C and look at the mapped intensity values.
  - there will be a roughly spherical region within C of non-zero intensity
  - radius of that region will be ℓ
  - the intensity value on the edge of that region will be $\overline{I_S} \equiv \frac{I_P}{\ell^3}$
  - the intensity at the center of that region will be $\overline{I_S} \cdot$ (the number of samples over P)

$$I_{center} = \overline{I_S} \cdot \left(\frac{\ell}{d\ell}\right)^3$$

  - the location of the center of that region will correspond to the original point P in region V
  - the intensity of point P can be calculated from

$$I_{center} = \frac{I_P}{\ell^3} \cdot \frac{\ell^3}{d\ell^3} \Rightarrow \frac{I_P}{d\ell^3} \Longrightarrow I_{center}\, d\ell^3 = I_P$$

Steps 6 & 7: File Save

File Save for original & acquisition Layers Working

Test Aquisition Simulation : OK

Back-fill Reconstruction

m_array
m_nLayers
m_xPxls
m_YPxs

CSim Space class for reconstructed Space
Create (truespace size, xsize, ysize)
- create (allocate) an array for truespace padded by xsize and y Size full o zeros of type float

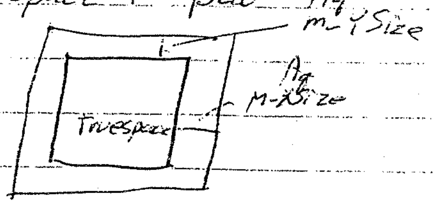
AddLayer (CAqLayer)
- add values to corresponding points in SimSpace
- increase layer count by one

~~Def~~ Mask (CAqLayer)
- create the ~~3D~~ mask of the point response function

void Clean () - restores to original condition, m-array

for Verification size of array = truespace + pad

xSize = m_xPxls + 2 m_xSize
ySize = m-yPxls + 2 m_ySize



Size of Aq Array = m_nPxls / Size + 1

mask creation loop is faulty

must go

$$x = \left(\frac{m\_xPxls}{2} - m\_xOrigin + 1\right);\quad x < \left(\frac{m\_xPxls}{2} + m\_xOrigin\right);\quad x{+}{+}$$

$$Y = \left(\frac{m\_yPxls}{2} - m\_yOrigin + 1\right);\quad Y < \left(\frac{m\_yPxls}{2} + m\_yOrigin\right);\quad Y{+}{+}$$

$$\{\quad index = Y \cdot m\_xPxls + X$$

$$xoff = \left|\frac{m\_xPxls}{2} - x\right|$$

$$Yoff = \left| m\_yPxls/2 - Y \right|$$

$$value = (xSize - xoff)(YSize - yoff)$$

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image restoration working for arithmetic avg
- only for reconstruction matrices of ~~even size~~ 2^n
- harmonic filter restoration is faulty

Probably due to filter mask being off center + causing phase shift

- division of $R(\omega, z)$ by $M(\omega, z)$ must only occur for significant values of $M(\omega, z)$

- need to fine tune file save default naming algorithm

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image restoration testing

@ 16×16 oversampling factor or resolution boost of 256 FFT induced noise becomes apparent
- Weiner restoration may reduce this artifect
- this will probably be more significant with real data
- much less significant in larger image file, may be due to edging effects in simulation process